Theorem. *Langevin's equation* (1) *has a unique solution. Further, uniqueness in law for* (1) *holds and the law is Gaussian.*

We will discuss the equation (1) for a further extended class of $L(t)$ and as an application a central limit theorem for a mean-field model of *multiplicative diffusions.*

References

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On the Existence and the Uniqueness of Solutions of the Noncausal Stochastic Integral Equation of Fredholm Type

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Let (z, φ) be a pair of a real continuous random function $z(t, w)$ $(t \geqslant 0)$ and an orthonormal basis $\{\varphi_n\}$ in $L^2(0, 1)$ such that each integral $\int_0^1 \varphi_n(s)\,\mathrm{d}z(s)$ has a definite meaning. Given a random function $f(t, w)$ and kernels $L(t, s, w)$, $K(t, s, w)$ $(0 \leqslant t, s \leqslant 1)$, we are concerned with the question of existence and uniqueness of solutions of the following stochastic integral equation,

$$x(t) = f(t) + \alpha \int_0^1 L(t, s, w)x(s)\,\mathrm{d}s + \beta \int_0^1 K(t, s, w)x(s)\,\mathrm{d}_\varphi z(s), \qquad (*)$$

where α, β are constants and the last term $\int d_\varphi z(s)$ stands for the stochastic integral of noncausal type, that is: the integral $\int_0^1 h(t, w)\,\mathrm{d}_\varphi z(t)$ of a random function $h(t, w)$ is defined to be the sum (in probability) of the series $\sum_n (h, \varphi_n) \int_0^1 \varphi_n(s)\,\mathrm{d}z(s)$.

The principal aim of the present exposition is to show some results on this subject. Furthermore, we will also refer to the relation between the integral equation of this type and the boundary value problems of stochastic differential equations containing the quantity $(\mathrm{d}/\mathrm{d}t)z(t, w)$ as a coefficient.

Skorohod's Stochastic Differential Equations with Reflecting Boundary Condition

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We consider a stochastic differential equation with reflecting boundary condition in a domain D of R^d. The problem is to obtain a unique solution of the following equation:

$$\mathrm{d}X(t) = \sigma(X(t))\,\mathrm{d}B(t) + b(X(t))\,\mathrm{d}t + d\Phi(t), \qquad (*)$$